

FRD Activities Report January 2001



Research Programs

Hurricane Balloons

The balloon/bladder interface for the top of the balloon is complete. The main purpose for the top balloon bladder interface is to provide a means to quickly release helium (cut-down device) to bring the balloon back to the ground. However, it also provides a platform for solar radiation and precipitation measurements, and for a slower, controlled helium release valve that is separate from cut-down device. Figure 1 shows this interface turned upside down to better illustrate the cutdown plug. The black plug is inflated to 20 psi with air to seal the helium inside the bladder. To release the helium, a small valve releases the air from the plug, allowing the plug to drop free of the 4-inch PVC pipe and allow the helium to escape. Release of the balloon super-pressure takes less than one minute. A subsequent soft landing of the balloon is calculated to occur in 2 to 5 minutes, depending on the balloon altitude. We have tested this in the lab and expect to flight test this during the next month. The longer 1.25 inch PVC pipe (Figure 1) provides a place for measuring



Figure 1. Top Balloon/bladder interface.

precipitation with a small pressure transducer. A 12-inch dome will be mounted on the top of the balloon bladder interface to provide rain protection for the balloon/bladder interface. The solar radiation sensor is also mounted in the dome. Signal and power for all of the sensors are provided via a cable from the transponder package (lower balloon/bladder interface) inside the base of the balloon.

The first prototype design of the transponder electronics is complete (see Figure 2). This provides an interface between all of the balloon sensors, balloon altitude controls, GPS receiver and the microprocessor based data acquisition system. The microprocessor and GPS receiver plug in on the solder side of the printed circuit board while all of the other electronics are mounted on the component side of the board. The electronics on the board provide the necessary amplifiers, solid state switches, power conversion, and some of the transducers and communications interface electronics to allow automated and remote operator control from the ground. (Randy.Johnson@noaa.gov)

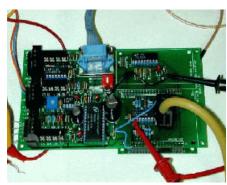


Figure 2. Transponder interface electronics.

AFTAC / Devine Umpire

Preparations are in progress for the upcoming AFTAC and Devine Umpire projects to be conducted this spring at Dugway Proving Ground, Utah. The main AFTAC field project will be conducted during a 3-week period in April. Three mobile SF_6 analyzers will be used to detect SF_6 at distances up to 80 km from the release site. The real-time SF_6 analyzers are being refurbished for this project (see below). We are also responsible for the SF_6 release, and an upgrade to the current release SF_6 mechanism is in progress. Plans call for the mechanism to support the simultaneous release of six 50 kg net wt. bottles of SF_6 on a mobile platform. Technicians at Dugway have developed a mobile stack which can be moved and set up in about one-half day to take advantage of prevailing wind conditions. Thus, our release system must also be mobile. (Kirk.Clawson@noaa.gov and staff)

Although our initial efforts at obtaining funding for Devine Umpire failed, we are now being funded to provide a ground-based real-time SF_6 detection system for the one day affair, scheduled for 28 February. Two hundred pounds of SF_6 will be released instantaneously in an explosive puff. We plan to track the invisible puff out to a distance of 80 km from the release site. To aid in tracking the puff, we plan to release a Hurricane Balloon (see previous article) into the puff. The balloon will transmit its position back to the control center, and this position will then be relayed to the driver of the van-mounted SF_6 detection system for the purpose of vectoring the van into the puff. The balloon will be used at no cost to the Devine Umpire project, because a suitable test bed is needed prior to actual deployment in hurricanes. (Kirk.Clawson@noaa.gov, Randy Johnson, Roger Carter, and staff)

The TGA-4000 continuous SF₆ analyzers are being prepared for use in the Devine Umpire project and again in the AFTAC project. One TGA-4000 is running in the laboratory to condition it for the Devine Umpire project. The detectors from the other seven analyzers have been sent back to the manufacturer for refurbishment. They are expected to be returned about the third week of February. This will give us slightly over a month to prepare for the AFTAC project, which is going to be a tight schedule. (Roger.Carter@noaa.gov)

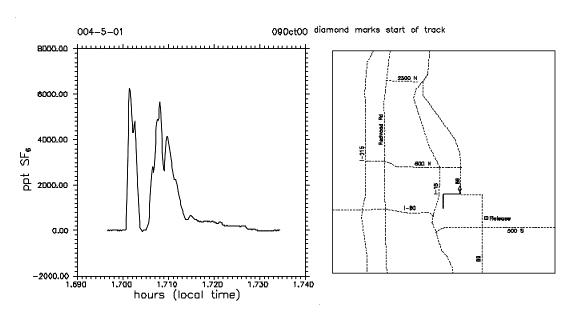
Refractive Turbulence Project

The final phase of the Refractive Turbulence Study-2000/01 was completed in mid-January. From mid-November through January, 15 research hours were flown. Data analysis continues, but preliminary results indicate that the objective, to test the re-design of the Fast, Ultra-Sensitive Temperature (FUST) probe, was successful. The new probe responds to 0.01 C temperature fluctuations on time scales less than 20 ms. Comparisons with the BAT probe indicated good agreement, but at frequencies higher than roughly 7 Hz, fluctuations from the two devices showed little or no coherence. Closer examination suggests fluctuations in the BAT temperature measurement do not respond to small temperature differences (at higher frequencies) and hence results in a quite noisy signal superimposed on one with only a few larger fluctuations. Work has begun to focus on integrating the new FUST sensor into the existing BAT framework. This will require some modification to both the BAT sensor boards and the housing. (Jeff.French@noaa.gov, Tim Crawford, Randy Johnson)

VTMX/URBAN 2000

The TGA-4000 continuous SF₆ analyzer data for the VTMX study have been converted to concentrations, verified, and plotted for the report. The accompanying figure illustrates the concentration of SF₆ measured during IOP 4 with van 5 together with the track of the van for the same time period. The SF₆ data from the gas chromatographs have been verified and we are in the process of identifying any samples that need to be re-run to insure their errors are within specifications. (Roger.Carter@noaa.gov, Debbie Lacroix)

Cooperative Research with INEEL



DOE Interagency Agreement

The local DOE office is in the process of developing a new Interagency Agreement with NOAA. There is some discussion as to whether the DOE will fund needed support items such as vehicle rental and telephone service through MASC or through the local Maintenance and Operations contractor. Proposals have been submitted to manage two additional meteorological towers installed by a DOE contractor, which are not in the INEEL mesonet database, and to update the now 12-year old *Climatology of the Idaho National Engineering and Environmental Laboratory*. Kudos were received from the DOE COTR recently on the much improved safety culture of the FRD team at the INEEL and its new spirit of cooperation in working with the M&O site contractor. (Kirk.Clawson@noaa.gov, and staff)

INEEL Mesoscale Meteorological Network

INEEL has requested that FRD produce joint frequency distributions for the wind observations from several towers in the Mesonet. These distributions will cover the calendar year 2000, and will divide the tower observations into 16 wind-direction bins, 9 wind-speed bins, and 6 stability bins. A set of programs has been written to create the distributions, largely based on C code

originally written by Jerry Sagendorf. The distributions will be included in the annual environmental report issued by INEEL. (Richard.Eckman@noaa.gov)

INEEL Mesoscale Modeling

Extensive efforts were made in January to track down the cause of the problems associated with downloading MM5 initialization files from the main National Weather Service ftp server. Often, the transfer of individual files is terminating prematurely. This started occurring several months ago and has been getting worse over time. The problem does not appear to be within FRD's own network domain. Both the INEEL network administrators and the administrators for the NWS server have so far not be able to find the source of the problem. Oddly, the same files that cause problems at FRD can be downloaded without incident at ATDD. These files can then be downloaded from ATDD to FRD without any problems. Possibly, the NWS server is treating the noaa.inel.gov domain differently from the noaa.gov domain. (Richard.Eckman@noaa.gov, Jerry Herwehe, ATDD)

Other Activities

Eleventh Symposium on Meteorological Observations and Instrumentation

The Eleventh Symposium on Meteorological Observations and Instrumentation (SMOI) was conducted from January 15 to 18, 2001, in Albuquerque, New Mexico in conjunction with the 81st Annual Meeting of the American Meteorological Society (AMS). The SMOI was organized and chaired by Jerry Crescenti. Overall, this symposium was very successful and included various topics. Oral sessions included:

- calibration methods
- quality assurance and quality control techniques
- sonic anemometers and extreme wind measurements
- surface energy
- fluxes
- radio- and rawinsondes
- aircraft platforms and aircraft
- clouds and visibility

- meteorological measurements in harsh environments
- quality assurance and quality control for meteorological networks
- rainfall
- water vapor and precipitable water
- radar wind profilers
- satellite measurements of the Earth's surface
- solar radiation

A poster session was also included in the SMOI. In addition, the SMOI hosted this year's Remote Sensing Lecturer. Robert D. Cess, from the State University of New York at Stony Brook presented a talk entitled "Satellite measurements of the Earth's radiation budget: what have we learned about the climate system?"

A total of 11 papers authored and coauthored by ARL scientists and engineers were presented in the SMOI. These individuals include Roger Carter, Kirk Clawson, Tim Crawford, Jerry Crescenti, Jeff French, and Randy Johnson (FRD); Dave Auble, Steve Brooks, Ron Dobosy, Ed Dumas, Tilden Meyers (ATDD); John Augustine and John Deluisi (SRRB); Alan Huber (AMSD); and Bill Elliott and Becky Ross (HQ). Tim Crawford and John Deluisi were also session chairs for the aircraft and solar radiation presentations, respectively.

The AMS Annual Meeting was also an opportunity for various members of ARL to get reacquainted with each other and to discuss various ARL issues. It was, in a sense, an informal ARL retreat. The 19 ARL scientists, engineers, and support personnel included Kirk Clawson, Tim Crawford, Jerry Crescenti, and Jeff French (FRD); Ron Dobosy, Ed Dumas, Will Pendergrass, and Barbara Shifflett (ATDD); John Augustine and John Deluisi (SRRB); Dennis Atkinson, Brian Eder, Jim Godowitch, Sharon LeDuc, and Evelyn Poole-Kober (ASMD); Jim Sanders and Walt Schalk (SORD); and Bill Elliott and Becky Ross (HQ). (Jerry.Crescenti@noaa.gov)



Figure 4. The AMS banquet allowed ARL staff to renew friendships and discuss various ARL issues. From left to right: Tim Crawford (FRD), John Augustine (SRRB), Jerry Crescenti (FRD), Kirk Clawson (FRD), Jim Sanders (SORD), and Brian Eder (ASMD).

AMS Short Course on Meteorological Instrumentation and Observation Techniques

In response to the lack of an instrumentation curriculum at most universities with meteorology programs, Jerry Crescenti, chair of the AMS Measurements Committee, organized a one-day short course on meteorological instrumentation and observation techniques. The focus of the course was on the basics of *in situ* monitoring and was oriented towards undergraduate and graduate students. This course was held on Sunday, January 14, 2001, in conjunction with the 81st Annual Meeting of the American Meteorological Society in Albuquerque, New Mexico. The short course lecture notes and slides can be found at http://measure.noaa.inel.gov. The short course instructors included C. Bruce Baker (NOAA / National Climate Data Center), Robert A. Baxter (Parsons Engineering Science), Paul M. Fransioli (Science Applications International Corporation), Scott J. Richardson (University of Oklahoma), Yvette P. Richardson (University of Oklahoma), Melanie A. Wetzel (Desert Research Institute), Daniel E. Wolfe (NOAA / Environmental Technology Laboratory). In addition to these notes, several key EPA guidance documents are also being used in this short course. Several vendors generously agreed to lend meteorological instrumentation to the short course for a "hands-on" experience.

The short course was a tremendous success and exceeded all expectations. A total of 56 participants enrolled for this one-day "crash" course. In general, student feedback was very positive about the content of the short course. (Jerry.Crescenti@noaa.gov)

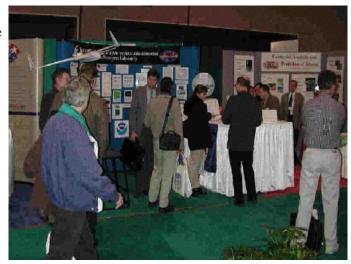
AMS Measurements Committee

Jerry Crescenti has finished a four-year appointment to the AMS Measurements Committee. Over the last three years, Crescenti has chaired this committee. The new chair is Dan Wolfe from NOAA's Environmental Technology Laboratory. (Jerry.Crescenti@noaa.gov)

ARL Booth

An ARL booth was featured in the exhibit hall during the 81st Annual Meeting of the American Meteorological Society (AMS) which was held from January 14-19, 2001, in Albuquerque, New Mexico. ARL technology was the central theme to the booth. Exhibit props included the Extreme

Turbulence (ET) probe jointly under development by FRD and ATDD, and a model of the LongEZ. Many brochures were available on programs conducted by each division. The booth provided an excellent opportunity to "show off" various ARL technological products and research programs. The booth was very successful and attracted a lot of interest. Barbara Shifflett (ATDD) and Jerry Crescenti have lead this intensive effort over the last several months. Several ARL personnel who attended the AMS Annual Meeting volunteered their time by manning the booth when the exhibit hall was open. (Jerry.Crescenti@noaa.gov, Tim Crawford, Figure 5. The ARL booth featured technology Jeff French, and Kirk Clawson).



including the Extreme Turbulence (ET) probe and a model of the LongEZ.

Proposals

The Vertical Tracer Exchange (VERTEX) proposal was completed in January and has been sent to the Air Force Technical Applications Center (AFTAC) for further consideration. The final proposal suggested a three-year program, with a pilot study in year 1, the main field study in year 2, and data analysis and modeling in year 3. The project would study the venting of pollutants through the top of the convective boundary layer using a combination of field studies and modeling based on large-eddy simulations (LES). (Richard.Eckman@noaa.gov)

Papers

- Sagendorf, J. F., R. G. Carter, and K. L. Clawson. In Press. MDIFF Transport and Diffusion Models. (To be published as NOAA Technical Memorandum)
- Vandemark, D., P. Mourad, T. Crawford, C. Vogel, and J. Sun, In Press. Measured correlation between roll-vortex signatures and radar-inferred sea surface roughness. *Journal of Geophysical Research*
- The following papers were presented at the Eleventh Symposium on Meteorological Observations and Instrumentation, Albuquerque, New Mexico:
- Clawson, K. L., D. A. Johnson, and N. Z. Saliendra. 2001. Initial comparison of fluxes from Bowen ratio and eddy correlation instrumentation over a sagebrush steppe ecosystem. Preprint, *Eleventh Symposium on Meteorological Observations and Instrumentation*, Albuquerque, NM, Jan. 14-19, Amer. Meteor. Soc., 72-73.
- Crawford, T. L., G. H. Crescenti, and J. M. Hacker. 2001. Small Environmental Research Aircraft (SERA): The future of airborne geoscience. Preprint, *Eleventh Symposium on Meteorological Observations and Instrumentation*, Albuquerque, NM, Amer. Meteor. Soc., 117-122.
- Dobosy, R. J., Crawford, T. L., D. L. Auble, G. H. Crescenti, and R. C. Johnson. 2001. The extreme turbulence (ET) probe for measuring boundary-layer turbulence during hurricane-force winds. Preprint, *Eleventh Symposium on Meteorological Observations and Instrumentation*, Albuquerque, NM, Jan. 14-19, Amer. Meteor. Soc., 50-54.
- French, J. R., T. L. Crawford, and R. C. Johnson. 2001. A high-resolution temperature probe for airborne measurements. Preprint, *Eleventh Symposium on Meteorological Observations and Instrumentation*, Albuquerque, NM, Jan. 14-19, Amer. Meteor. Soc., 139-144.
- Johnson, R., R. Carter, S. Businger, G. Barnes, and J. Businger. 2001. Improved smart balloon to better characterize hurricane boundary-layer inflow. Preprint, *Eleventh Symposium on Meteorological Observations and Instrumentation*, Albuquerque, NM, Jan. 14-19, Amer. Meteor. Soc., 182-187.
- Wright, C. W., and J. R. French. 2001. Comparison of aircraft attitude determination by GPS, INS, and airborne laser: preliminary results. Preprint, *Eleventh Symposium on Meteorological Observations and Instrumentation*, Albuquerque, NM, Jan. 14-19, Amer. Meteor. Soc., 134-138.

Travel

January 2-4, Tim Crawford and Jerry Crescenti traveled to the Airlie Conference Center in Warrenton, Virginia to attend a CBLAST Workshop.

January 9-11, Kirk Clawson traveled to Dugway, Utah, to attend a planning meeting for the AFTAC project that is scheduled to begin this April.

January 13-19, Jerry Crescenti traveled to Albuquerque, New Mexico to attend the 81st Annual Meeting of the American Meteorological Society (AMS), to chair the Eleventh Symposium on Meteorological Observations and Instrumentation, to chair the AMS Short Course on the Introduction to Meteorological Instrumentation and Observation Techniques, and to coordinate the ARL booth in the exhibit hall.

January 14-18, Tim Crawford, Jeff French, and Kirk Clawson traveled to Albuquerque, New Mexico to attend the 81st Annual Meeting of the American Meteorological Society (AMS), and to present several papers in the Eleventh Symposium on Meteorological Observations and Instrumentation.

Visitors

On January 17, Dr. Joost Businger, Emeritus Professor at the University of Washington, visited Randy Johnson and to discuss the Hurricane Smart Balloon project.

Awards

Jerry Crescenti received a Cash-In-Your-Account award for his leadership and organization efforts at the January Annual American Meteorological Society Meeting in Albuquerque, New Mexico. Jerry volunteered to organize and chair the Eleventh Symposium on Meteorological Observations and Instrumentation. Not only did he organize an excellent session, but he encouraged ARL staff who submitted and presented eleven papers. Jerry also initiated and lead the effort to have an ARL Booth at the meeting. Months before the meeting, he contacted and encouraged ARL scientists to display their research work at the ARL Booth. Jerry's dedication and hard work to this cause is highly commendable.